MECH 472: Thermal Systems Design

Fall 2015

Instructor: Laura Schaefer, MEB 106, x3836, las14@rice.edu

Class Hours: TR, 8-9:15 am, DCH 1064 (3 credits)

Office Hours: TR, 10-11 am, and by appointment (subject to adjustment after beginning of semester)

Objectives: This course will provide students with the tools to analyze and design energy systems.

Outcomes: At the conclusion of this course, students should be able to integrate material from the basic courses in thermodynamics, fluid mechanics, and heat transfer into the design of various thermal systems; gain experience in using computer techniques in modeling and simulating typical thermal systems; perform economic calculations involving time and interest; and be familiar with the environmental impact of energy systems.

Textbook: There is NO required textbook. One **recommended** textbook is Design of Fluid Thermal Systems, 4th ed., by Janna (earlier editions are also fine). Some other **optional** textbooks include Design of Thermal Systems by Stoecker, and Thermal Design and Optimization by Bejan, Tsatsaronis & Moran. Additionally, you should have access to the texts used in your Thermodynamics, Fluids, and Heat Transfer courses. I will also post notes from various textbooks/sources on the web page and I have put a few textbooks (including the ones listed above) on reserve in the library.

Grading:

DP Midterm Report (10/6) - 20%	Two Exams (10/1? & 11/24?) - 10% each
DP Final Report (12/1) - 25%	Subject Presentation 1 (9/17+) - 5%
DP Final Presentation - 10%	Subject Presentation 2 (11/12+) - 5%
Log Books - 5%	Homework - 10 %

For all graded assignments, clarity in logic and in presentation is crucial.

DP: The cornerstone of this class is a group design project (DP). Groups should be 5 students (depending on the enrollment, there may be 1-2 4 person teams). Teams must submit their members by the end of class on 9/1, and their 1st, 2nd, and 3rd choices for the project by the end of the day on 9/4 (a Friday). In addition to the reports and presentation, a continuing assignment is to keep a project logbook (this will be discussed in class).

SPs: In addition to design project groups, groups of two students will do two short subject presentations (SPs; ~5 minutes) during the class. The first subject presentation will focus on economics, pipes, or pumps, and the second subject presentation will focus on heat exchangers, fuel cells, or advanced energy systems. Examples of these topics will be posted on the web.

Homework: Late homework will not be accepted. Homework is due at the beginning of class (with a 10 minute tardy window). Not necessarily every HW problem will be graded.

Attendance: There is no explicit numerical penalty for missing class. However, in previous iterations of this course, I have observed a strong correlation between attendance and homework grades (and the resulting performance on exams). Moreover, group participation will be a factor in your final grade on the design project.

Honor Code: Exams require the honor code statement and signature. Homework should be your own work, but studying and discussing the problems with others is permissible. Project work should be the group's effort. It is acceptable to discuss your project with others, but the work submitted must be that of only your group.

ADA Notice: If you have a documented disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Disability Support Services (Allen Center, Room 111 / adarice@rice.edu / x5841) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

Course Topics:

1. Introduction and Review of the Basic Equations (Course Policy and RTT)
2. Economics (Present/Future Worth, Investments)
3. Piping Systems (Flow Calcs and Networks)
4. Pumps (Types and Performance Evaluation)
5. Heat Exchangers (Evaluation and Physical Design Specifications)
6. Fuel Cells (and possibly other advanced cycles)
7. Other Considerations (LCA, Ethics, etc.)
8. System Simulation (Classes and Methods) – Time Permitting
9. Optimization and Thermoeconomics (Definitions and Search Methods) – Time Permitting

The above topics are subject to change based on the pace of the class and class dynamics.